

Mathematics 255    Au, Wi, Sp, Su    5 cr.

**Differential Equations  
and Their Applications**

**Prerequisite:**

Mathematics 254. Not open to students with credit for 415, or 556.

**Catalog Description:**

Basic concepts and methods in solving ordinary differential equations, first and second order, linear differential equations, series solutions, numerical methods, Laplace transforms, physical applications.

**Purpose of Course:**

This course is an introduction to the most basic concepts and methods in solving ordinary differential equations. The emphasis of this course is on problem solving. Upon completion of this course students should know some applications of ordinary differential equations in engineering, physics and some other branches of the sciences.

**Text:**

Elementary Differential Equations and Boundary Value Problems, 7<sup>th</sup> OSU Custom Edition, by Boyce/DiPrima, Wiley, ISBN 0471655198

**Topics List:**

<b><u>Sections</u></b>	<b><u>Topics</u></b>	<b><u>Approximate Time</u></b>
	<b>Introduction</b>	
1.1	Some Basic Mathematical Models; Direction Fields	2 lectures
1.2	Solutions of Some Differential Equations	
1.3	Classification of Differential Equations	
2.2	Separable Equations	
	<b>First Order Differential Equations</b>	
2.1	Linear Equations with Variable Coefficients	6 lectures
2.4	Differences Between Linear and Nonlinear Equations	
2.5	Autonomous Equations and Population Dynamics	
2.6	Exact Equations and Integrating Factors	
2.7	Numerical Approximations: Euler's Method	
2.8	The Existence and Uniqueness Theorem	
	<b>Second Order Linear Equations</b>	

3.1	Homogeneous Equations with Constant Coefficients	5 lectures
3.2	Fundamental Solutions of Linear Homogeneous Equations	
3.3	Linear Independence and the Wronskian	
3.4	Complex Roots of the Characteristic Equation	
3.5	Repeated Roots; Reduction of Order	
3.6	Nonhomogeneous Equations; Method of Undetermined Coefficients	
3.7	Variation of Parameters	

### ***MIDTERM #1***

#### **Higher Order Linear Equations**

4.1	General Theory of $n$ th Order Linear Equations	6 lectures
4.2	Homogeneous Equations with Constant Coefficients	
4.3	The Method of Undetermined Coefficients	
4.4	The Method of Variation of Parameters	

#### **Series Solutions of Second Order Linear Equations**

5.1	Review of Power Series	6 lectures
5.2	Series Solutions near an Ordinary Point, Part I	
5.3	Series Solutions near an Ordinary Point, Part II	
5.4	Regular Singular Points	
5.5	Euler Equations	
5.6	Series Solutions near a Regular Singular Point, Part I	
5.7	Series Solutions near a Regular Singular Point, Part II	

### ***MIDTERM #2***

#### **The Laplace Transform**

6.1	Definition of the Laplace Transform	5 lectures
6.2	Solution of Initial Value Problems	
6.3	Step Functions	
6.4	Differential Equations with Discontinuous Forcing Functions	
6.5	Impulse Functions	
6.6	The Convolution Integral	